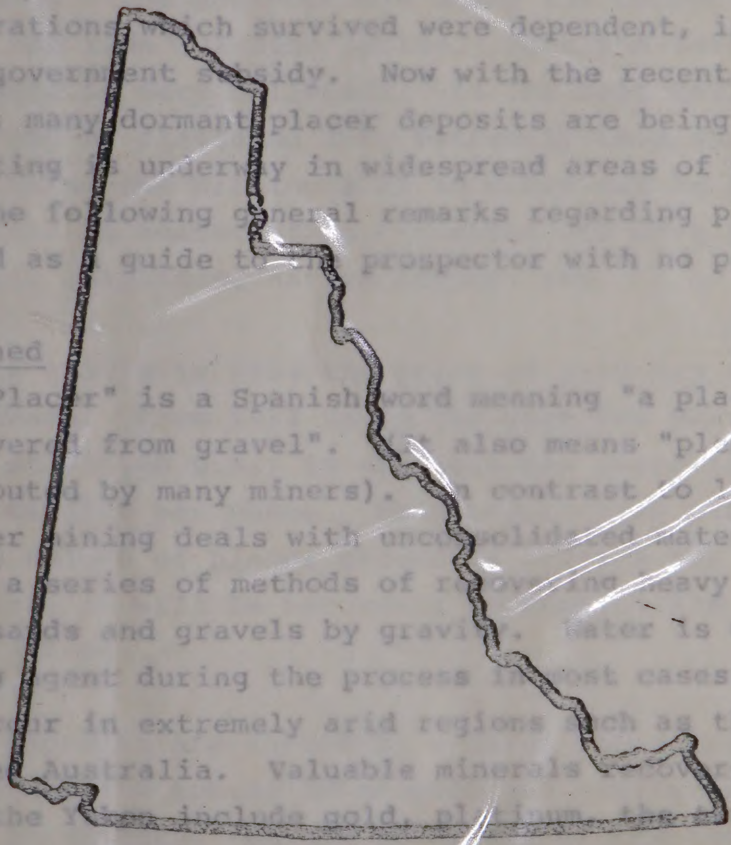
NOTES ON PLACER MINING IN THE YUKON TERRITORY



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NOTES ON PLACER MINING IN THE YUKON TERRITORY

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Dept. of Indian and Northern Affairs
Whitehorse, Yukon Territory, 1974

The discovery of rich placer gold deposits in the Klondike area of the Yukon in 1896 greatly accelerated the settlement and development of the Territory, and, until the mid 1960's, provided the main economic base. Latterly, rising costs of labour and supplies versus a fixed price of $35 per ounce for gold, forced most placer operations into an uneconomic situation. The few operations which survived were dependent, in most cases, on federal government subsidy. Now with the recent increase in gold prices, many dormant placer deposits are being reactivated and prospecting is underway in widespread areas of the Territory.

The following general remarks regarding placer mining are intended as a guide to the prospector with no placer experience.

Placer Defined

"Placer" is a Spanish word meaning "a place where gold can be recovered from gravel". (It also means "pleasure" - a meaning disputed by many miners). In contrast to lode, or "hard-rock", placer mining deals with unconsolidated material, and is essentially a series of methods of recovering heavy minerals from less dense sands and gravels by gravity. Water is used as the transporting agent during the process in most cases, although "dry diggings" occur in extremely arid regions such as the American Southwest and Australia. Valuable minerals recovered by placer methods in the Yukon include gold, platinum, the tungsten minerals - scheelite and wolframite, and to a lesser extent: cassiterite (stream tin), native copper, and many of the metallic sulphides. In all cases gold is the major product and only rarely do "by product" minerals occur in sufficient quantities to be marketable.

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Physical properties of gold

Gold may be recognized by its characteristic colour and metallic lustre, its softness, and its extreme density. Pure gold does not occur naturally: it is always alloyed with more or less silver and other metals. For example, in the Yukon, gold varies from about 60% to 95% contained gold (overall average about 80%). Pure gold is almost twice as dense as lead and about seven times as dense as average rock; i.e. the sand and gravel which constitute the bulk of a placer deposit. Various other heavy minerals can be mistaken for gold - the most notable being the copper sulphide chalcopyrite and the iron sulphide pyrite. Both the latter are brittle whereas gold is very malleable. As the most malleable of all metals, gold may be flattened into extremely thin sheets: a flat particle weighing one billionth of an ounce can be seen with the naked eye. Gold is resistant to oxidation and most acids; unlike the metallic sulphides, native copper, etc.

Gold Prices

From the 1850's to 1934 the price of gold was about $20.67 U.S. per ounce. From 1934 up to the past few year's the price was pegged at $35.00 U.S.; in the past few years the price has been as high as $180 per ounce. When researching old publications which cite values of placer ground in dollars per yard or square bedrock foot, it will be necessary to convert the values into present-day prices.

General Theory

Placer deposits are formed by natural concentration of heavy minerals during the course of erosion and weathering of mineralized rock formations. As the rocks are broken down the finer and lighter fragments are transported by run-off water downstream while the heavier minerals tend to sink toward bedrock and remain closer to their source. Thus coarse pieces of gold will usually be found close to the source while finely divided flakes and "dust" may be transported considerable distances downstream. An example of the latter is the deposition of fine gold at the upstream end of river bars and islands. Further concentrating is

effected by tributary streams and meandering of the main stream as it cuts its channel through the valley. Prolonged downcutting and meandering tends to leave deposits of concentrated gravels (usually near the sides of the valley) thereby forming "bench placers" some distance vertically above the present stream bed.

Placer deposits in the Yukon are usually creek or bench deposits; river bar placers are of minor importance although this latter type was the first found and mined in the 1870's.

Typically, but more so in the Yukon, the richest gravels are those closest to bedrock. (In a few isolated cases in the Territory, all the gold is in the bedrock, and none in the gravels). Most operators excavate the first two or three feet of bedrock - depending on the type of rock occurring and the ease with which it may be removed. In extreme cases, placer gold has penetrated down to twelve feet into highly fractured bedrock. Many of the placer deposits in the Yukon are underlain by soft, decomposed schists: these present few problems. Frequently, however, beds of hard rocks such as quartzites will be encountered and cleaning bedrock with the aid of trowels, spoons, brooms, etc. can be a very time-consuming and labourious process.

Permafrost

Placer mining, in one form or the other, has taken place in most areas of the world over many years; but one feature of northern placers sets them apart from temperate zone deposits - permafrost. Much of the placer ground in the Territory is permanently frozen: this fact raises a totally new set of problems to overcome. As an example; most of the Klondike area creek gravels are overlain by several feet of "black muck" - a mixture of fine silt, decomposed vegetation, and water. This layer is from 50-75% water but is frozen and well insulated by a thick layer of moss. Once the moss is stripped off, the muck thaws quite rapidly: especially if subjected to running water. The gravels thaw much more slowly and this can be a very real problem regards production. Frozen gravels, if necessary, can be thawed by artificial heat such as steam, hot or cold water, or wood fires; but the only economical way is by natural thawing and the application of water during the summer. The use of heavy machinery and explosives have

proved to be unsatisfactory. In most cases frozen ground will not be a problem for the prospector since he normally will be testing by panning along a creek where the first thawing takes place. Should further testing of ground be required, however, the Yukon prospector will very likely become involved with permafrost.

Glaciation

Valley glaciation normally destroys any placer deposits. The placer prospector should study geological maps showing glaciation interpretation with respect to the area being considered. As a rough guide, glaciated valleys normally have a U-shaped cross-section as opposed to a V-shaped for unglaciated. (The existence of the Klondike gold field is the result of the presence of gold-bearing quartz veins as a source plus the absence of glaciation in the northwestern part of the Territory).

The location of a placer deposit is dependent on the history of the stream and the serious prospector will look for evidence of former stream channels in order to formulate theories regarding possible "pay-streaks" Right or wrong, these theories must be checked out by actual testing of the gravels.

Prospecting

The gold pan is a useful and necessary device for testing and cleaning up but is much too slow and labourious for even a small-scale placer operation. The standard 16" pan will only hold about 1/150th of a cubic yard and the average panner would be hardpressed to wash 1/2 yard per day. However, preliminary testing of a stream may be accomplished using only a pan, a pick, and a shovel. The usual procedure is to work upstream taking frequent pans from material as close to bedrock as possible. Additional pans should be taken where tributary streams enter the main stream as reconcentration often takes place at these points. By recording location of pans taken and amount of gold seen in the pan, an idea of the best section of the creek may be obtained. Individual particles or flakes of gold ("colours") are counted and recorded. A "rule of thumb" with placer miners is that if a grain of gold, when dropped into the pan gives an audible "ping"; then it is probably worth at least five cents at today's prices.

Should initial testing prove encouraging, then the best section of the stream should be more thoroughly tested by the use of a rocker, a small sluice box, or a suction dredge. Subsequent testing of placer ground is then normally followed by test pits, shafts, drifts, drilling, or open-cutting sections using machinery; or a combination of some or all of these methods. Most placer operations fail through insufficient testing of the ground to be mined.

Where water is scarce, the rocker is probably the most practical unit. It can be constructed with a minimum of materials and carpentry experience. Given the same conditions, a miner operating a rocker rather than a gold pan can increase the volume of gravel washed by about ten times; i.e. up to three yards per day.

If water is plentiful and the grade of the stream bed is steep enough (a minimum of 1 foot drop in 25 feet), a small sluice box or boxes may be used to advantage. Depending again on conditions, a miner should be able to shovel in about five to ten yards per day.

Building plans and instructions for use of rockers, sluice boxes, riffles, etc. appear in most publications dealing with placer, and the reader is referred to the accompanying bibliography.

Very little data are available on the performance of suction dredges in the Yukon; models available differ greatly with respect to power, recovery system, etc. The initial cost is very high compared to a rocker or sluice boxes and the prospective purchaser should study the manufacturer's specifications especially in the areas of volume capability, maintenance, weight, etc. before buying one.

Where testing or small-scale mining is to be carried out in many different locations, the purchase or rental of a small gasoline-driven pump complete with hoses and flexible plastic water lines can be of great help, especially when gravels would have to be transported to water or vice versa.

Shallow test pits (5 ft.) present few problems, but deeper pits or shafts usually require timbering and precautions unfamiliar

to the amateur. Inexperience in shaft sinking or drifting can lead to very dangerous working conditions.

Production

The potential miner should always bear in mind that gold production varies directly as the volume of gravels efficiently processed. An example of the quantities involved in placer mining may be shown from 1973 production of several randomly picked operations in the Klondike area. For each fine ounce of gold recovered, the total volumes moved (including stripping of muck and waste gravels) ranged from 20 to 200 cubic yards. Hydraulicked volumes frequently averaged much higher. In "average ground" a panner would be unlikely to recover more than $2 or $3 per day. On the other hand, one operator reported recovering 10 ounces from a 1/2 yard remnant left by the "old timers".

Generally speaking, a mineable placer deposit requires three main features: gold, water, and tailings room. Specifically, factors that must be considered include: value per yard, extent of the pay gravels, amount of water readily or potentially available, amount of overburden or waste gravels to move, position of the water table, size of boulders, type and grade of bedrock, thawing of frozen ground, location of the deposit with respect to access and downstream consequences, occurrence of heavy minerals other than gold, etc. In addition, recent legislation imposes restrictions where environmental or ecological damage may result from placer operations. The main requirement, of course, is the presence of economic quantities of gold; factors governing its extraction require careful study and frequently a good deal of ingenuity.

Deposits rich enough to mine at a profit by hand methods are extremely rare. Included in this category are small areas left or missed by previous miners, possible undiscovered deposits, or high-grade sections encountered during the course of mechanized operations. All medium to large-scale operations are usually mechanized to a high degree; the exception being the few hydraulic mines in the Yukon which are able to utilize "gravity water".

The commonest placer mining method in the Territory is the use of a bulldozer or front-end loader to supply gravels to a steel sluice box. The beginner is strongly urged to visit the Klondike gold fields and examine some of the mines there. Many of the properties are easily accessible by two-wheel drive vehicles, and most miners are willing to explain their operation provided that they are not interrupted during their work.

Placer Areas

Locations of productive placer areas and recent placer activities are shown on the accompanying sketch. Open ground in most historically productive areas has largely been staked or leased in the past few years. In most cases, claim posts are quite conspicuous, but the placer miner searching for "ground" should check with the Mining Recorder regarding status of the area. In any event one should obtain a copy of the Yukon Placer Act from the recorder and study the rules and regulations - which are strictly enforced.

Much of the Territory has been geologically mapped and reports on these areas are available for purchase or research at the Regional Geologist's office in Whitehorse. Most government publications dealing only with placer are now out of print, but several are on file and may be researched at the same office.

Selling Gold

When selling gold, a few points are worth remembering for the amateur. If the gold is to be taken out of the Yukon it is subject to a small royalty (currently 22 1/2 cents per ounce) payable to the Mining Recorder. Placer gold in the Territory ranges in purity from 60 to 95 per cent; its exact fineness not determined until final refining. Prices fluctuate daily for refined gold; and jewellery-grade gold is dependent on supply and demand. The gold buyer, in addition to being entitled to a fee for his services, must protect himself with respect to price changes, unknown purity, shipping charges, insurance, etc. The seller, in turn, should get quotes on prices offered for this gold to ensure a maximum return. Premium prices are usually available

for attractive nuggets and other coarse pieces used in the manufacture of raw-gold jewellery.

Regulations

A popular misconception about the Yukon Territory is that the region is still a Robert Service-type of wilderness with " no holds barred". This is no longer the case: legislation is now in effect with respect to all phases of activities in the field.

A prospector intending to start even a small-scale mining operation requires a licence to use the necessary water. In addition, certain conditions may be imposed regarding stream pollution. Information about water use may be obtained from the Water, Lands and Forests Division of the Dept. of Indian and Northern Affairs in Whitehorse.

For those prospectors entertaining ideas about "living off the land", the following statement by the Director of the Game Branch may be enlightening:" All animals and birds wild by nature are protected except those which are classified as "game". Game birds and animals can be taken during the specified open season and at specified bag limits. No person shall hunt unless authorized by a licence issued to him. No person under the age of 14 is eligible for any licence. Persons between the ages of 14 and 16 can obtain a licence, but must be accompanied by a licenced hunter over the age of 21.

Holders of resident hunter licences may take snowshoe hares and ground squirrels (gophers). A non-resident, not being the holder of a valid hunting licence issued under the Game Ordinance or having other lawful occasion, shall keep all firearms securely stowed in the motor vehicle or trailer, boat or aircraft used by him".

If remote areas of the Territory are being considered as prospecting targets, then the R.C.M. Police should be notified re area, expected length of time in the area, and a contact in civilization. This is for the prospector's benefit in case of accident or other mishap necessitating search or rescue.

The successful placer miner should be a combination of geologist, carpenter, woodsman, mechanic, etc. and be willing to do hard work under often trying conditions. He also requires a fair amount of luck.

Following the decline of interest in placer after the 1930's, most publications on this subject are now out of print. New books are currently appearing in bookstores and the reader should investigate this source. A few of the government publications still available are as follows:

H.S. Bostock:
1957: Yukon Territory, selected field reports of the Geological Survey of Canada, 1898 to 1933; Geol. Surv. Can., Mem 284.

A.H. Lang:
1970: Prospecting in Canada, 4th edition; Geol. Surv. Can., Economic Geol. Rept. #7.

Officers of the Dept. of Mines - British Columbia:
Notes on Placer mining in B.C.; Bull 21.

(The first two are available at the office of the Regional Geologist, Whitehorse).

Considerable literature has been published on the subject of placer and most public and geological libraries have, or can obtain many of these texts.

Index to Accompanying Map

1. Klondike
2. Mayo-McQuesten
3. Kluane
4. Firth
5. Fortymile-Sixtymile-Ladue
6. Stewart River
7. Dawson Range
8. Livingstone
9. Whitehorse
10. Liard

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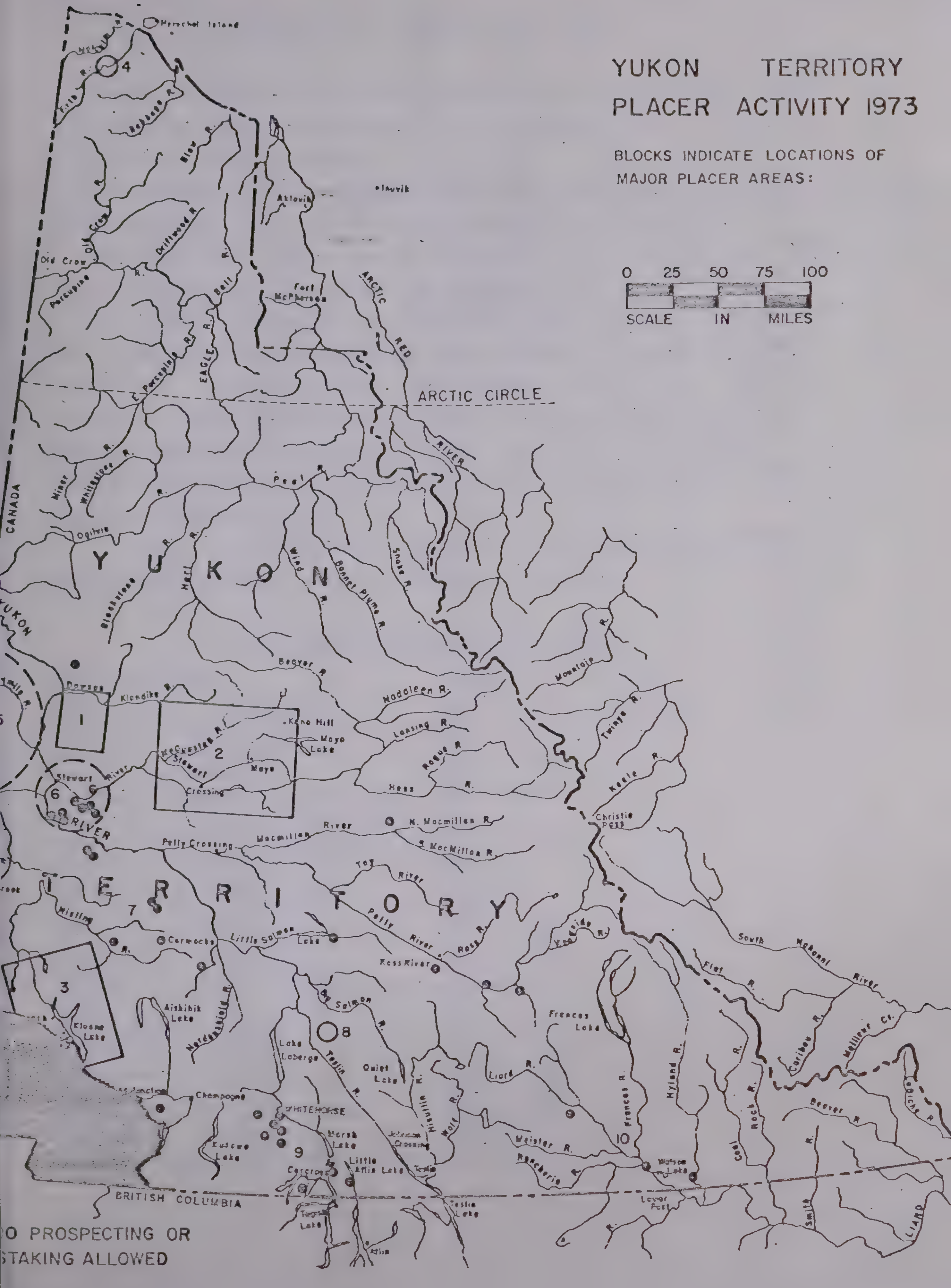

YUKON TERRITORY PLACER ACTIVITY 1973

BLOCKS INDICATE LOCATIONS OF MAJOR PLACER AREAS:

0 25 50 75 100
SCALE IN MILES

O PROSPECTING OR
STAKING ALLOWED

Fineness of Yukon Placer Gold

This incomplete list was compiled from Geological Survey of Canada reports, gold-buyer's lists and personal communications with placer miners.

Since fairly wide ranges of purity exist even on relatively small creeks, this list may be used as a guide only.

Figures tabulated are in fineness: i.e. - parts per 1000 of pure gold; the remainder is usually silver, with minor amounts of base metals. To calculate the value of contained gold multiply the fineness by the current price of refined gold: e.g. - Allgold Creek, 860 x $150. = $129. per ounce of raw gold. The unweighted average fineness of this list is 800 and the range from 605 to 946. (In 1905, the average fineness of approximately 500,000 ounces shipped from the Klondike area was 775).

A name in parentheses following the creek name refers to main drainage to aid in location on map.

FINENESS OF YUKON PLACER GOLD

KLONDIKE AREA	RANGE
Adams Gulch (Bonanza)	615 - 746
American Hill (Bonanza)	864
Allgold (Klondike R.)	860
Bear (Klondike R.)	644 - 726
Bonanza - upper (Klondike R.)	809 - 827
Bonanza - middle (Klondike R.)	781
Bonanza -lower (Klondike R.)	739 - 798
Bonanza - discovery (Klon. R.)	762
Boulder (Bonanza)	800
Claffey Pup (Quartz)	750
Caribou (Dominion)	816 - 840
Cheechako (Bonanza)	750 - 785
Dago Hill (Hunker)	798 - 859
Dominion - upper (Indian R.)	810
Dominion -lower	847
Dominion - middle	817 - 835
Eighty Pup (Hunker)	797
Eldorado (Bonanza)	633 - 783
Eureka (Indian R.)	677 - 727
French Gulch (Eldorado)	631 - 676
Gay Gulch (Eldorado)	780
Gauvin Gulch (Bonanza)	664

Gold Bottom (Hunker)	780 - 800
Gold Run (Dominion)	848 - 860
Gold Hill (Eldorado)	768
Goring (Klondike R.)	738
Henry Gulch (Hunker)	605 - 650
Homestake (Bonanza)	663
Hunker (Klondike)	701 - 859
Hunker - Right Fork	802 - 804
Hunker - Upper	798 - 859
Hunker - Mouth	701 - 726
Indian R. (Yukon R.)	843
Irish Gulch (Eldorado)	624 - 742
Jackson Gulch (Klondike R.)	829 - 842
King Solomon Hill (Bonanza)	785 - 800
Last Chance (Hunker)	683 - 832
Lombard Pup (Dominion)	860
Lovett Gulch (Bonanza)	808 - 836
Little Blanche (Quartz)	658
Montana (Indian R.)	770
Monte Cristo (Bonanza)	784 - 796
Mint Gulch (Hunker)	851
Oro Grande (Eldorado)	775
Paradise Hill (Hunker)	735 - 802
Quartz (Indian R.)	732 - 784
Skookum (Bonanza)	605
Sulphur (Dominion)	797 - 821
Trail Hill (Bonanza)	800 - 805
Victoria Gulch (Bonanza)	807 - 820

SIXTYMILE AREA

Big Gold (Sixtymile R.)	854
Glacier (Sixtymile R.)	830 - 860
Fortymile R. (Yukon R.)	814 - 820
Matson (Sixtymile)	775
Miller (Sixtymile)	827 - 857
Moose (Fortymile R.)	855
Poker (U.S. Side) (Fortymile)	873
Sixtymile R. (Yukon R.)	808
Tenmile (Sixtymile)	830 - 845

STEWART R. AREA

Ballarat (Yukon R.)	852
Barker (Stewart R.)	793 - 900
Black Hills (Stewart R.)	750 - 855
Henderson (Yukon R.)	725 - 730
Independence (Stewart R.)	780 - 794
Kirkman (Yukon R.)	860 - 896
Mariposa (Scroggie)	900
Scroggie (Stewart R.)	900 - 905
Stewart R. (Yukon R.)	837 - 850
Thistle (Yukon R.)	848 - 895
Canadian (Yukon R.)	864 - 883

MAYO-McQUESTEN AREA

Anderson (Mayo R.)	720 - 728
Clear (McQuesten R.)	828 - 860
Davidson (Mayo R.)	840
Dublin Gulch (McQuesten R.)	860 - 923
Duncan (Mayo R.)	792 - 802
Haggart (McQuesten R.)	885 - 895
Highet (Mayo R.)	832 - 845
Johnson (McQuesten R.)	760 - 820
Ledge (Mayo R.)	808 - 820
Lightning (Mayo R.)	830
Minto (Mayo R.)	827 - 835
Steep (Mayo R.)	931 - 946
Thunder Gulch (Lightning)	790 - 825

KLUANE AREA

Burwash (Kluane R.)	871 - 876
Bullion (Slims R.)	871

BIG SALMON AREA

Lake (S. Big Salmon R.)	895
Livingstone (S. Big Salmon R)	880

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